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INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION BETWEEN CANADA AND THE UNITED STATES FOR THE PROTECTION, PRESERVATION AND EXTENSION OF THE SOCKEYE AND PINK SALMON FISHERIES IN THE FRASER RIVER SYSTEM

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ANNUAL REPORT
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NEW WESTMINSTER
CANADA
1963

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

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DIRECTOR OF INVESTIGATIONS
LOYD A. ROYAL

NEW WESTMINSTER
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FIGURE 1 — A view of Weaver Creek, at the upper end of the sockeye spawning area, showing the ravages of previous floods and the extensive gravel deposits. Further down the creek, the creek elevation is now higher than the surrounding land due to the deposition of gravel by erosion from logging operations.

REPORT OF THE
INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION
FOR THE YEAR 1962

The International Pacific Salmon Fisheries Commission was founded on the principle of "find the facts before taking action". This principle led to the creation of a small, continuing research organization directly associated with the management of the Fraser River sockeye fishery and since 1957 with the pink salmon fishery as well. Every research effort of the Commission has been dedicated to its terms of reference which provide for the protection, preservation and extension of the sockeye and pink salmon fisheries. Recognizing that poorly planned or executed research or inadequate interpretation of the results is possibly worse than no research at all, the Commission, applying the scientific concepts of its first director, Dr. W. F. Thompson, has expended its scientific efforts towards measuring the environmental factors controlling productivity. The purpose of the Commission's research program has not varied since its inception in 1937.

It is not the intent of this report to redocument all the technical findings that have contributed to the gradual rehabilitation of the Fraser River sockeye fishery or to an understanding of how the pink salmon fishery must be managed to regain its pre-Hell's Gate importance. It is the purpose to demonstrate herein that realistic application must be associated with fact finding if economic benefits are to accrue. Sound research without physical application of the findings is an economic waste. If the benefits of research are not realized because of the failure to act accordingly, unrelated action without facts may be taken eventually by an aroused public, such action usually harming the fishery resource more often than it provides positive benefits.

Because the assembling of facts through properly planned and executed research is often a slow and difficult process, no delay should be permitted in applying the data, once obtained, to the benefit of the fishery resource. Experience has shown that the benefits resulting from such an application can be exceptionally large in relation to cost. Eight years of research were required to isolate the Hell's Gate obstruction as the principal cause for the continued low level in the abundance of Fraser River sockeye. The elimination of this obstruction by the construction of fishways in 1945 cost $1,000,000 yet the benefits from the fishways combined with improved management of the fishery have averaged $8,000,000 annually from 1949 to date and may be expected to be even larger in future years.

A careful study of spawning requirements for a period of 14 years, as detailed later in this report, can result in benefits to the fishing industry in any one year far in excess of the total cost of the investigations. Fortunately, the application of these latter findings does not require extra budgetary funds since it is automatically provided for in a redefinition of the management requirements of the fishery. An exact knowledge of spawning requirements benefits the industry either through increased catches or as a guarantee against reduced catches because of overfishing.

The economic benefits as listed above are illustrations of the application of knowledge gained through scientific research. There are several other examples

already in operation in regard to the Fraser River sockeye and pink salmon populations and there is an imperative need for new applications based on recently acquired information. This need is associated with the possibility of such large monetary gains that these potential gains quickly negate any and all questions arising either from the international character of the fishery or the possible need for controlling governmental expenditure. No business ever would hesitate to invest in a project which could return the entire capital investment plus a profit in as short a period as two to four years with only a very limited risk.

Fishways for Early Stuart Sockeye Run

An examination of the reports by the Factors of the Hudson's Bay Company dating back to 1825 for Fort St. James at the outlet of Stuart Lake, combined with an examination of the sockeye catches since the beginning of the present Century, reveal that the Early Stuart sockeye run has been held far below its potential productivity by periodic natural high water obstructions in the Fraser Canyon.

Scientific investigations have shown conclusively that when the peak of the spring runoff in the Fraser River is delayed until July the upstream migration of Early Stuart sockeye is seriously delayed or blocked at several points in the Fraser Canyon with a resulting serious decline in productivity. This adverse situation has occurred periodically before the advent of the Hell's Gate obstruction in 1913 and probably back at least to 1825. The construction of the main Hell's Gate fishway in 1945 and an additional high level fishway in 1951 aided by a series of favorable flow years has permitted the Early Stuart run to reach levels of abundance *far above any existing naturally since 1825*. The estimated size of the run for comparative periods is listed below:

Average Annual Total Runs of Early Stuart Sockeye by Cycle

	1961 Cycle	*1960 Cycle*	*1959 Cycle*	*1958 Cycle*	*Average*
1949 to 1961	770,433	123,221	138,789	132,968	328,205
1915 to 1948	166,063	7,956	6,011	23,938	48,403
1900 to 1914	30,650	41,250	15,333	68,250	40,440

The increase in the Early Stuart sockeye run has been reflected by increased catches in the related fishery. For all cycles combined the average annual catch for the 13 years from 1949 has increased by 179,000 sockeye over the period from 1900 to 1914 (before the Hell's Gate obstruction) and by 166,000 fish over the period from 1915 to 1948. Based on 1961 wholesale prices for canned sockeye the catch has increased in value by about $700,000 annually or a total increase in value of approximately $9,000,000 during this 13 year period. Available spawning and rearing facilities for this race of sockeye have not been wholly utilized as yet so that further increases can be expected in future years.

However, evidence of uncorrected obstructions to the upstream migration of the Early Stuart sockeye run became available in 1955 and 1960, both 'off-year' cycles of production. Obstructed migration in 1955 followed by a serious decline in the size of the returning run in 1959 proved that three additional small fish-

ways are necessary to protect the present productivity of this run and to provide for the obtaining of maximum production. The economic loss from the occurrence of the block to migration in 1955 and 1960 will exceed $1,000,000. Had the 1961 run been blocked the future loss for that single cycle year would have been in the millions of dollars. The cost of constructing the required fishways is estimated at approximately $180,000. The conclusion is inescapable, that without construction of the proposed fishways, the existing gains on this run with the related important economic benefits cannot be maintained nor can the future increases to perhaps double the current run be obtained. The required funds have been requested from the two governments.

The protection and continued rehabilitation of the Early Stuart run through the construction of fishways is only one of many projects that can now be substantiated with facts which reveal the possibility of rather startling economic benefits. Some of these projects are protective, some would extend production and some would provide both protection of existing runs and rehabilitation beyond previous records of production. A project of the latter type is proposed for Weaver Creek.

Artificial Spawning Channel for Weaver Creek

Weaver Creek has a native sockeye run, the emergent fry migrating down Weaver Creek into Harrison River and thence upstream to Harrison Lake. The rearing capacity of the latter is relatively untouched because of limited spawning areas for the sockeye populations spending their lacustrine period of life in the lake. Weaver Creek is typical of several streams in the Lower Fraser River delta. The stream has a precipitous source and spawning can take place only in the short part of the stream lying in the valley plain. Logging of the headwaters has resulted in serious erosion and the deposition of large quantities of gravel over the existing spawning areas. A continued deposition of surplus gravel over the spawning area is inevitable because of the lowered velocities which created the spawning area initially. The excess gravel becomes unstable under varying winter flow conditions thus reducing the survival rate of incubating eggs. The egg to fry survival rate in Weaver Creek now averages only 6 per cent and is only 2.4 per cent in very adverse years. If the declining run is to be saved and increased, new spawning grounds must be constructed having a controlled flow free from the effects of watershed erosion (See Figure 1).

Laboratory findings indicate that egg to fry losses reaching as high as 97.6 per cent in the case of Weaver Creek are non-selective. In other words, an increase in the egg to fry survival rate by providing effective spawning area should not reduce the potential ability of the increased number of fry to survive to maturity. Continually increasing pink salmon runs to the Jones Creek channel constructed for the Department of Fisheries of Canada in 1954 tends to substantiate the laboratory findings. Physical examination of fry produced in controlled spawning areas indicates that they are equivalent to fry produced in natural uncontrolled streams. This favorable similarity does not exist in the case of salmon fry artificially propagated by existing methods, the latter being measurably inferior in several ways.

Experience gained from (1) the Quesnel Field Station operation dating back to 1949; (2) the Jones Creek spawning channel constructed in 1954; (3) the first

year of operation of the Seton Creek spawning channel (1961); and (4) sockeye production to the smolt stage resulting from a spawning channel operated by the Washington Department of Fisheries at Baker Lake indicates that a controlled spawning channel on Weaver Creek would increase fry production from an average of 6 per cent to between 40 and 55 per cent, a factor of 7 to 9 with a comparable increase in adult survival.

The construction cost of a spawning channel at Weaver Creek currently is estimated at between $150,000 and $190,000 and the annual maintenance cost at $9500. The *annual* benefits accruing from increased sockeye runs will range from a minimum of $250,000 to $2,000,000 annually depending on the marine survival rate of the yearling smolts leaving Harrison Lake. If a channel is not constructed for the protection of the declining sockeye run to Weaver Creek the past economic importance of this population will disappear for all time. Moreover, this project offers the best opportunity for utilizing the enormous, but unproductive rearing capacity of Harrison Lake.

Water Temperature Control for Horsefly and Nadina Rivers

Another problem deserving immediate attention is the serious loss of unspawned sockeye that occurred in 1961 as a result of high water temperatures both in the Fraser River and in many of the important spawning tributaries; this loss being fully detailed in the 1961 Annual Report. A further report is now being prepared for publication that proves that high water temperatures at or immediately prior to spawning are related to the death of unspawned sockeye. In some streams adverse water temperatures seldom occur but in others such as the Horsefly River high water temperatures can be expected to occur with increasing frequency as a result of recent forest fires and extensive logging operations.

The sockeye run to the Horsefly River, tributary to Quesnel Lake, has been rehabilitated at a rapid rate since the construction of the Hell's Gate fishways in 1945. The following is the escapement record for the dominant cycle from 1941 to date.

Sockeye Escapement to Horsefly River

1941	1,065
*1945	3,000
1949	20,000
1953	105,000
1957	226,000
1961	296,000 + catch of 600,000

*Hell's Gate Fishways commenced operation

Warm water resulted in 25 per cent of the Horsefly escapement dying before spawning in 1953. The loss to the industry from this mortality was substantial but the loss from warm water in 1961 was disastrous. Water temperatures in 1961 are believed to be the highest for several decades. A total of 62 per cent of the 1961 Horsefly escapement, or 183,520 fish died without spawning. While the known marine return has varied from one to 19 adults per spawner during the

past ten years, an average return is five adult fish per spawner. The loss of unspawned fish will cause a reduction in the 1965 run of 917,600 fish based on average survival rates. Such a reduction in the Horsefly run will cost the fishermen $2,202,000 and the canners about $4,500,000.

While the economic loss in 1961 caused by the mortality of unspawned fish in the Horsefly River will be severe, the mortality can be expected to reoccur at fairly frequent intervals. In future years when the run approaches its original size, as existed before the Hell's Gate obstruction, the potential loss can be several times as severe as the actual loss which will result from the death of unspawned fish in 1961.

The only remedial procedure for providing a solution is the diversion of an acceptable source of cold water to the Horsefly River at or above the major spawning grounds for moderating high water temperatures when they occur. Engineering surveys have revealed the availability of sufficient supplies of cold water in adjacent lakes which if introduced into the Horsefly River when required would prevent the loss of unspawned fish. Final cost estimates for diverting cold water to the Horsefly River are not yet available but it is currently believed that the construction cost would not exceed $750,000 and possibly less. Since maintenance costs are not expected to exceed $2,000 per year it is essential that these protective facilities be made available as soon as possible and certainly before 1965 when the dominant run returns.

Similar temperature control facilities can be constructed at a much lower cost on the Nadina River where 86 per cent of the run to this area was lost in 1961.

The construction and operation of the above listed fish protective and fish production facilities combined with additional findings from current research programs will open the way to effective and economic salmon production. Sufficient information is now available to justify the start of a continuing program on a firm economic basis. Improvement in design and in the effectiveness of operation will no doubt occur as time goes on but much of this improvement can only result from prototype operations. Research has provided the facts. It is now imperative that the Commission proceed with their physical application. The initial cost for such a program including the facilities recommended above is estimated at $150,000 per year to each country over a five-year period. The cost of the program in relation to potential benefits is extremely low. It is the intention of the Commission to furnish each government with a detailed scientific justification for each project prior to construction as it has done in the case of the fishways proposed for the protection of the Early Stuart Sockeye run (The History of the Early Stuart Run—Progress Report No. 10—1962).

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held twelve formal meetings during 1962 with the approved minutes of these meetings being submitted to the Governments of the United States and Canada. The first meeting

of the year was held on January 18 and 19, the meeting on January 19 being with the Commission's Advisory Committee composed of the following members:

Canada	*United States*
Richard Nelson Salmon Processors	John Plancich Salmon Processors
Harold Christenson (alternate for Charles Clarke) Purse Seine Fishermen	N. Mladinich Purse Seine Fishermen
Peter Jenewein Gill Net Fishermen	Joe Erisman Gill Net Fishermen
H. Stavenes Purse Seine Crew Members	John Brown Reef Net Fishermen
R. H. Stanton Troll Fishermen	Bert G. Johnston Troll Fishermen
J. C. Murray Sport Fishermen	Howard Gray Sport Fishermen

The tentative recommendations for regulation of the 1962 sockeye and pink salmon fishery in Convention waters, as submitted to the Advisory Committee on December 19, 1961, were discussed and certain revisions made on the basis of the presentations by the Committee. The Commission reviewed the progress in rehabilitation of Fraser River sockeye and pink salmon and agreed on the necessity of establishing an experimental spawning channel for sockeye.

The Commission met in executive session on April 16, 1962 to consider additional fishway construction required for the continued protection and extension of certain races of Fraser River sockeye and pink salmon. A review was presented of the studies being conducted at the Sweltzer Creek Field Station and the Pitt Field Station with particular emphasis on the effects of alterations in the natural environment of the salmon. The possible development of longlining gear for the taking of sockeye and pink salmon on the High Seas was noted and it was agreed that the Governments of Canada and the United States should be made aware of the implications of such gear on the management problems related to Fraser River sockeye and pink salmon. The tentative budget for 1963-1964 was unanimously approved subject to reconsideration before its submission to the respective governments.

On June 25, 1962 the Commission met in executive session for a review of the problems arising in regard to fishway construction in the Fraser and Thompson River Canyons. Mr. Fred Bullock was appointed Advisory Committee representative for the United States troll fishermen to fill the vacancy left by the resignation of Mr. Bert G. Johnston. Technical reports were received on 1. a theoretical means of obtaining water temperature control in the Horsefly and Nadina Rivers, 2. quality comparison of hatchery produced and naturally produced wild fry, and 3. the use of prepared spawning channels to bring underutilized lakes into full production. In the afternoon the Commission met with its Advisory Committee to discuss various problems involved in the protection and extension of Fraser River sockeye and pink salmon.

Separate meetings of the Commission were required on July 23, August 14, 21, and 28, 1962 to provide for adjustment of the regulatory controls on the sockeye fishery in an effort to achieve the desired escapement and an equitable division of the sockeye catch.

The eighth meeting of 1962 was held with the Advisory Committee on August 30 for a full discussion of the problem of properly managing the Adams River sockeye fishery with emphasis given to the regulatory control required for obtaining the desired escapement.

Two further meetings for regulatory purposes were required on September 5 and 7, 1962.

The Commission met again on September 25, 1962 when regulatory problems related to the management of the sockeye fishery were considered and further regulatory measures approved. A discussion was held on the possible pollution problem which would result from the construction of the kraft pulp mills at Prince George and Kamloops on the Fraser River watershed.

The twelfth and final meeting of the year was held on December 12, 13 and 14 with the first two days devoted to general business. On December 14 the annual open meeting was held with the Advisory Committee and approximately 800 members of the fishing industry at which time the various aspects of the 1962 fishing season, a summary of possible factors influencing the 1963 sockeye and pink salmon runs and the tentative proposals for regulation of these fisheries were presented for consideration by the Advisory Committee.

1962 REGULATIONS

Recommendations for regulations governing the 1962 sockeye and pink salmon fishery in Canadian Convention waters were adopted at a meeting of the Commission held on January 19, 1962 and submitted for approval and implementation to the Government of Canada on February 2, 1962. Recommendations for regulations governing the 1962 sockeye and pink salmon fishery in United States Convention waters were adopted at a meeting of the Commission held on January 19, 1962 and submitted to the Government of the United States for approval and to the State of Washington for implementation on February 2, 1962. The recommendations for Canadian Convention waters were implemented by the Government of Canada in an Order-in-Council dated April 5, 1962 and for United States Convention waters by an Order of the Director of the Washington State Department of Fisheries on April 19, 1962.

The recommendations of the Commission were as follows:

Canadian Convention Waters

The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends that regulations to the following effect, in the interests of such fisheries, be adopted by Order-in-Council as amendments to the Special Fishery Regulations for British Columbia, for the season of 1962 under the authority of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Area 20 and that portion of Area 19 lying westerly of a straight line drawn across Juan de Fuca Strait joining William Head and Angeles Point through Race Rocks commencing at point of intersection with the international boundary line with purse seines:

(a) From the 24th day of June, 1962, to six o'clock in the forenoon of the 6th day of August, 1962; and

(b) From the 6th day of August, 1962, to the 8th day of September, 1962, both dates inclusive, except from six o'clock in the forenoon to six o'clock in the afternoon of Monday and Tuesday in each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 24th day of June, 1962, to six o'clock in the afternoon of the 6th day of August, 1962; and

(b) From the 6th day of August, 1962, to the 8th day of September, 1962, both dates inclusive, except from

(i) six o'clock in the afternoon of Monday to six o'clock in the forenoon of Tuesday; and

(ii) six o'clock in the afternoon of Tuesday to six o'clock in the forenoon of Wednesday in each week.

2. No person shall fish for sockeye or pink salmon in the waters of the said southern portion of District No. 3 embraced in areas 17 and 18 and that portion of Area 19 lying easterly of a straight line drawn across Juan de Fuca Strait joining William Head and Angeles Point through Race Rocks commencing at point of intersection with the international boundary line by means of nets:

(a) From the 24th day of June, 1962, to eight o'clock in the forenoon of the 23rd day of July, 1962;

(b) From the 23rd day of July, 1962, to the 25th day of August, 1962, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday in each week; and

(c) From the 26th day of August, 1962, to the 8th day of September, 1962, both dates inclusive.

3. No person shall fish for sockeye or pink salmon in the waters of the said southern portion of District No. 3 embraced in Areas 17 and 18 by means of nets from the 9th day of September, 1962, to the 30th day of September, 1962, both dates inclusive.

4. No person shall fish for sockeye or pink salmon in District No. 1 by means of nets:

(a) From the 24th day of June, 1962, to the 21st day of July, 1962, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday in each week; and

(b) From the 22nd day of July, 1962, to the 7th day of October, 1962, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week, and except for those sockeye or pink salmon taken in gill nets having mesh of not less than 9 inches extension measure for linen and 9½ inches extension measure for synthetic fibre nets as authorized for the taking of spring salmon by the Area Director of Fisheries for British Columbia after consultation with the Commission and pursuant to the provisions of the British Columbia Fishery Regulations during any week of this period that a complete emergency closure may be required for the protection of sockeye or pink salmon.

5. No person shall fish for sockeye or pink salmon in the Convention waters of Canada lying easterly and inside of a line projected from Gower Point at the northerly entrance to Howe Sound to Thrasher Rock Light thence in a westerly direction to the most northerly point on Valdez Island, thence following the easterly shoreline of Valdez Island to Vernaci Point, thence in a straight line to Race Point on Galiano Island, thence following the easterly shoreline of Galiano Island to Mary Anne Point, thence in a straight line to the flashing white light on Georgina Point at the entrance to Active Pass, thence in a straight line toward Point Roberts Light to point of intersection with the international boundary line, thence following the international boundary line to point of intersection with the mainland by means of commercial trolling gear from the 12th day of August, 1962, to the 7th day of October, 1962, both dates inclusive, except at such times that net fishing other than with spring salmon nets may be permitted within this area.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Director of Fisheries of the State of Washington, that regulations to the following effect in the interests of such fisheries, be adopted by him for the year 1962 by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. (1) No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying easterly of a straight line drawn from the lighthouse on Tatoosh Island in the State of Washington to Bonilla Point in the Province of British Columbia and westerly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines:

(a) From the 24th day of June, 1962, to five o'clock in the forenoon of the 6th day of August, 1962; and

(b) From the 6th day of August, 1962, to the 8th day of September, 1962, both dates inclusive except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday and Tuesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 24th day of June, 1962, to seven o'clock in the afternoon of the 6th day of August, 1962; and

(b) From the 6th day of August, 1962, to the 8th day of September, 1962, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

2. (1) No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying easterly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines or reef nets:

(a) From the 24th day of June, 1962, to five o'clock in the forenoon of the 23rd day of July, 1962; and

(b) From the 23rd day of July, 1962, to the 8th day of September, 1962, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday and Tuesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 24th day of June, 1962, to seven o'clock in the afternoon of the 23rd day of July, 1962; and

(b) From the 23rd day of July, 1962, to the 8th day of September, 1962, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

3. Section 2 above does not apply to sockeye or pink salmon taken in nets having mesh of not less than 8½ inches extension measure from the 24th day of June, 1962, to the 22nd day of July, 1962, both dates inclusive, when such net fishing gear has been authorized for the taking of chinook salmon by the Director of Fisheries of the State of Washington.

4. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn true south from the southeast tip of Point Roberts in the State of Washington (otherwise known as Lilly Point) to the international boundary line from the 2nd day of September, 1962, to the 30th day of September, 1962, both dates inclusive.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time.

In making the above recommendations for regulatory control of sockeye and pink salmon fishing in the Convention waters of the United States of America for the year 1962 the Commission recognizes the need for the continued maintenance of certain previously established preserves by the Director of Fisheries of the State of Washington for the protection and preservation of other species of food fish."

Emergency Amendments

In order to provide for adequate racial escapement of Fraser River sockeye and for an equal share of the season's catch by the fishermen of Canada and the United States in view of developing runs and fishing operations, the approved regulations as detailed above were later amended on recommendation of the Commission. A detailed list of the regulatory amendments is as follows:

July 10, 1962 — In the interest of harvesting a greater percentage of the Early Stuart run of sockeye an additional 24 hours of fishing was permitted in District No. I of Canadian Convention waters effective July 11.

July 23, 1962 — In the interest of harvesting a greater percentage of the current run of sockeye an additional 24 hours of fishing was permitted in all Canadian Convention waters lying easterly of the William Head-Angeles Point line effective July 24. Also on this date a 24 hour extension in fishing time effective July 25 was permitted in United States Convention waters lying easterly of the William Head-Angeles Point line in the interest of equitable division of the allowable catch.

July 24, 1962 — An additional 24 hours in fishing time was granted to fishermen in United States Convention waters lying easterly of the William Head-Angeles Point line effective July 26, such additional fishing time being considered necessary in view of the small size of the fishing fleet.

July 30, 1962 — A substantial escapement of sockeye from United States waters into Canadian Convention waters lying easterly of the William Head-Angeles Point line warranted an additional 24 hours in fishing time in those waters effective July 31.

July 31, 1962 — In consideration of the relatively small fishing fleet an additional 24 hours fishing time was permitted in United States Convention waters lying easterly of the William Head-Angeles Point line effective August 1.

August 1, 1962 — In the interest of equalizing the catch of sockeye between the fishermen of the two countries, fishing time was increased an additional 24 hours effective August 2 in United States Convention waters lying easterly of the William Head-Angeles Point line.

August 7, 1962 — In the interest of equalizing the catch of sockeye salmon between the fishermen of the two countries fishing time was increased by 24 hours effective August 8 in the United States Convention waters lying easterly of the William Head-Angeles Point line.

August 10, 1962 — To permit adequate conservation of the summer races of sockeye salmon, fishing was closed during the week commencing August 12 in Canadian Convention waters lying easterly of the William Head-Angeles Point line. In view of the expected small run of Adams River sockeye fishing in Canadian Convention waters lying westerly of the William Head-Angeles Point line was limited to one day's fishing on August 13 for the week commencing August 12.

August 14, 1962 — A substantial increase in the escapement of sockeye in the Fraser River made it possible to permit one day's fishing on August 15 in those Canadian Convention waters lying easterly of the William Head-Angeles Point line.

August 21, 1962 — In the interest of conservation of the Adams River sockeye run all United States Convention waters and all Canadian Convention waters lying easterly of the William Head-Angeles Point line were closed until September 3.

August 23, 1962 — In the interest of conservation of the Adams River sockeye salmon all Canadian Convention waters lying westerly of the William Head-Angeles Point line were closed until September 3.

August 27, 1962 — On the basis of increased test fishing catches of Adams River sockeye salmon at the entrance to Juan de Fuca Strait one day of fishing was permitted effective August 28 in those Canadian Convention waters lying westerly of the William Head-Angeles Point line. On this date the Department of Fisheries of Canada opened the Fraser River proper to fishing with spring salmon nets effective 7:00 a.m. to 7:00 p.m. August 29 to permit a reasonable exploitation of the spring salmon population.

August 28, 1962 — In the interest of equitable division of the sockeye catch and an adequate harvest of the Adams River run sockeye fishing was permitted in the Canadian Convention waters lying westerly of the William Head-Angeles Point line on August 29 through August 31. For the same reason all United States Convention waters were opened for 24 hours effective August 29.

August 30, 1962 — The Commission relinquished regulatory control in all Convention waters lying westerly of the William Head-Angeles Point line effective September 2. Also on this date one day of additional fishing was permitted in United States Convention waters lying easterly of the William Head-Angeles Point line except for the waters lying northerly of a line extended from Point Whitehorn to Patos Island thence due west to the international boundary effective August 31 to be followed by a closure of all United States Convention waters lying easterly of the above line until such time as the Commission was satisfied that additional sockeye fishing was warranted. To measure the number of sockeye available for escapement in Georgia Strait Canadian Convention waters of District No. I were opened an additional day effective September 4.

September 5, 1962 — In view of the indicated surplus of sockeye delaying in the Gulf of Georgia over that required for escapement the Canadian Convention waters of District No. I were opened an additional 24 hours effective September 6. Also on this date in the interest of equitable division of the catch all United States Convention waters lying easterly of the William Head-Angeles Point line except those waters lying westerly of a line projected true south from West Point Roberts Light to the international boundary were opened to fishing for 48 hours effective September 6.

September 7, 1962 — To provide additional information on the number of Adams River sockeye available for escapement 24 hours of fishing was permitted in the Canadian Convention waters of District No. I westerly of the "Blue Line" effective 6:00 p.m. September 9. The referenced area is defined as follows:

> "That portion of District No. 1 lying outside of, that is westerly and southerly of a straight line drawn from Point Grey to Point Grey Buoy, thence to the light on the westerly end of North Arm Jetty, thence to Sand Heads Light, thence to Canoe Pass Buoy, thence to the light on the westerly end of Tsawwassen Causeway, thence through West Point Roberts Light to the International Boundary Line."

September 10, 1962 — The failure of sockeye catches on the night of September 9 to indicate any surplus over that required for escapement made it necessary to close all of District No. I of Canadian Convention waters from 6:00 p.m. September 10 to 8:00 a.m. September 17.

September 14, 1962 — A delay in the upstream migration of the Adams River escapement necessitated a further closure of District No. I of Canadian Convention waters for the week commencing September 16.

September 16, 1962 — In the interest of permitting a reasonable exploitation of the spring salmon population the Department of Fisheries of Canada opened the Fraser River proper to fishing with spring salmon nets only for the period 7:00 a.m. to 7:00 p.m. on September 18.

September 21, 1962 — To provide for an adequate escapement of Adams River sockeye a further closure of District No. I of Canadian Convention waters was necessitated for the week commencing September 23.

September 25, 1962 — As the Adams River sockeye escapement started up the Fraser River on September 20 it was possible to relinquish regulatory control of the United States Convention waters in the West Point Roberts area effective 5:00 p.m. (D.S.T.) September 26. On the same date and for the same reason regulatory control of the Canadian Convention waters of Areas 17 and 18 was relinquished effective 5:00 p.m. (D.S.T.) September 26.

September 28, 1962 — The escapement of Adams River sockeye having been obtained regulatory control of troll fishing in all districts was relinquished effective 6:00 p.m. (D.S.T.) September 30 and sockeye net fishing in District No. I of Canadian Convention waters was permitted for 48 hours effective at 8:00 a.m. October 3. Regulatory control of all net fishing in District No. I was relinquished effective 8:00 a.m. October 8 completing the Commission's regulatory obligations in Convention waters for the 1962 season.

SOCKEYE SALMON REPORT

The Fishery

The 1962 sockeye run declined substantially over that of the brood year (1958) and can be classed as a relative failure. The decline was not unexpected since it was predicted by the Commission staff at a meeting held on December 19, 1961 with the Advisory Committee and several hundred representatives of the industry. The major cause of the decline in the 1962 sockeye run was a very low level of marine survival which can now be anticipated on the basis of the indicators described in the 1961 Annual Report.

The extremely poor marine survival of the 1962 sockeye run made it necessary to impose severe restrictions on the fishery in order to obtain a satisfactory escapement. This limited amount of fishing made it very difficult to manage the run properly in spite of substantial test fishing operations. In addition, it was not possible to determine exactly the timing of the peak of the important Adams River run in the fishery, although it appeared to be quite similar to that of 1954 and much earlier than 1958. The timing of the 1962 Adams run adds further evidence of the existence of a normal eight-year cycle frequency of alternating early and late runs.

The average weight of 1962 sockeye was only slightly above the cycle average for four-year-old fish (6.41 lbs.) but was considerably above that of the brood year.

Cyclical Average Weights of Four-Year-Old Fraser River Sockeye

Cycle Year	*Average Weight Pounds*	*Cycle Year*	*Average Weight Pounds*	*Cycle Year*	*Average Weight Pounds*
1918	6.30	1934	6.19	1950	6.96
1922	6.05	1938	6.69	1954	6.84
1926	6.31	1942	6.58	1958	5.93
1930	6.57	1946	5.86	1962	6.62

The share of the Canadian catch taken in Juan de Fuca Strait dropped significantly from that of the brood year primarily due to a substantial decrease in the purse seine landings. The stringent restrictions placed on the fishing during the Adams River run in order to obtain a satisfactory escapement did not permit the Canadian Strait fishery, which did not open until August 6, to compensate for the catches made in the Fraser River fishery earlier in the season. Although the purse seine catches decreased significantly, the share of the Canadian catch taken by gill nets in Juan de Fuca Strait increased substantially over that of the brood year as shown in the following table.

Per Cent of Canadian Sockeye Catch Taken in Juan de Fuca Strait		*Per Cent of Canadian Sockeye Catch Taken by Purse Seine in Juan de Fuca Strait**		*Per Cent of Canadian Sockeye Catch Taken by Gill Nets in Juan de Fuca Strait**	
Cycle Year	*Per Cent*	*Maximum P.S. Units*	*Per Cent*	*Maximum G.N. Units*	*Per Cent*
1962	35.94	74	19.97	311	15.77
1958	54.14	120	45.56	463	8.27
1954	36.42	139	33.68	101	1.86
1950	32.41	91	27.44	39	0.53
1946	13.49	84	12.52	9	0.08

*Troll catches not listed.

There was an unexplained increase of 50 per cent in the efficiency of the Fraser River fishery during the Early Stuart run and this made it very difficult to obtain a proper catch-escapement relationship for this race. The small Adams River run also caused serious regulatory difficulties. The limited amount of fishing during the Adams run made it very difficult to assess properly the timing and the size of the run and proper management of the fishery was accomplished only by limiting fishing to an absolute minimum. This was particularly true of the Fraser River fishery which was permitted only the minimum amount of fishing necessary to measure correctly the number of Adams River sockeye delaying off the mouth of the Fraser River. To fulfill minimum escapement requirements, it was then necessary to restrict completely the river fishery during the upstream migration of the Adams River run. In spite of the conditions which prevailed, a reasonable division of the season's catch between the two countries and a minimum escapement representing 60 per cent of the Adams run was obtained.

The total catch of sockeye (1,595,036) as well as the number of cases packed was the smallest on this cycle since 1926 (Table II). The share of the catch by each country was as follows: Canada 52.44 per cent and the United States 47.56 per cent.

The advantages of a reduction in the number of units of gear were clearly demonstrated in 1962. Because of the predicted small run for the season, a number of units of gear from United States Convention waters went elsewhere to fish during the early season runs, particularly those runs appearing prior to August 10, and this permitted a reasonable amount of fishing during that part of the season in spite of the low marine survival. Later in the season during the Adams River run, the number of units of gear had increased sufficiently to amply demonstrate the seriousness of even one day too much fishing. In spite of the fact that the number of units of gear in United States Convention waters during the 1962 Adams River run was below normal for this cycle, the United States fleet was still able to catch almost 10 per cent of the total Adams River run in the one day allowed during the peak of the run. Since equal division of the catch is required between the two countries, this one day's catch, when balanced by an equivalent catch in Canadian waters, actually represented 20 per cent of the total Adams River run. The serious problems involved in attempting to scientifically manage an over-developed salmon fishery once again were clearly illustrated in 1962.

The portion of the Fraser River sockeye run returning through Johnstone Strait in 1962 was, if anything, slightly below normal with only 7.4 per cent of the total catch of Fraser River sockeye, or 3.7 per cent of the total Fraser River sockeye run, being caught in that area.

Escapement

The term "adequate escapement" invariably is incorporated into any discussion relative to the management of a salmon fishery. In spite of the frequent usage of the term the usual definition applied is that adequate escapement represents the number of spawners required to provide for a maximum sustained yield—a vague and superficial definition at best. Realistic definition of an adequate escapement represents a very complex problem for there can be a number of factors involved. Even though all of these factors may be recognized and catalogued their functions in relation to production usually are either poorly understood or not understood at all.

In the case of the Fraser River sockeye a number of factors are considered in determining the desired annual escapement for the several discrete populations. With most of the populations there has been a naturally controlled and consistent variation in their annual production recorded for a period covering at least 138 years. There is a large run produced every fourth year, preceded or followed by a run of lesser size with very small runs occurring in the two intervening years. Considerable evidence indicates that the consistent variation in productivity of the four cycle runs is caused primarily by an interrelation of the sockeye population with one or more predator populations during the period of existence in fresh water. To provide large escapements every year through arbitrary restriction of the fishery could upset the interrelationship established naturally between the predator and sockeye populations and result in a decline in the total production for each four year period. There is increasing evidence also that a similarly functioning interrelation could exist beween the food for sockeye and annual sockeye production which would be a highly sensitive and therefore a dangerous control if the status of predators was modified or eliminated.

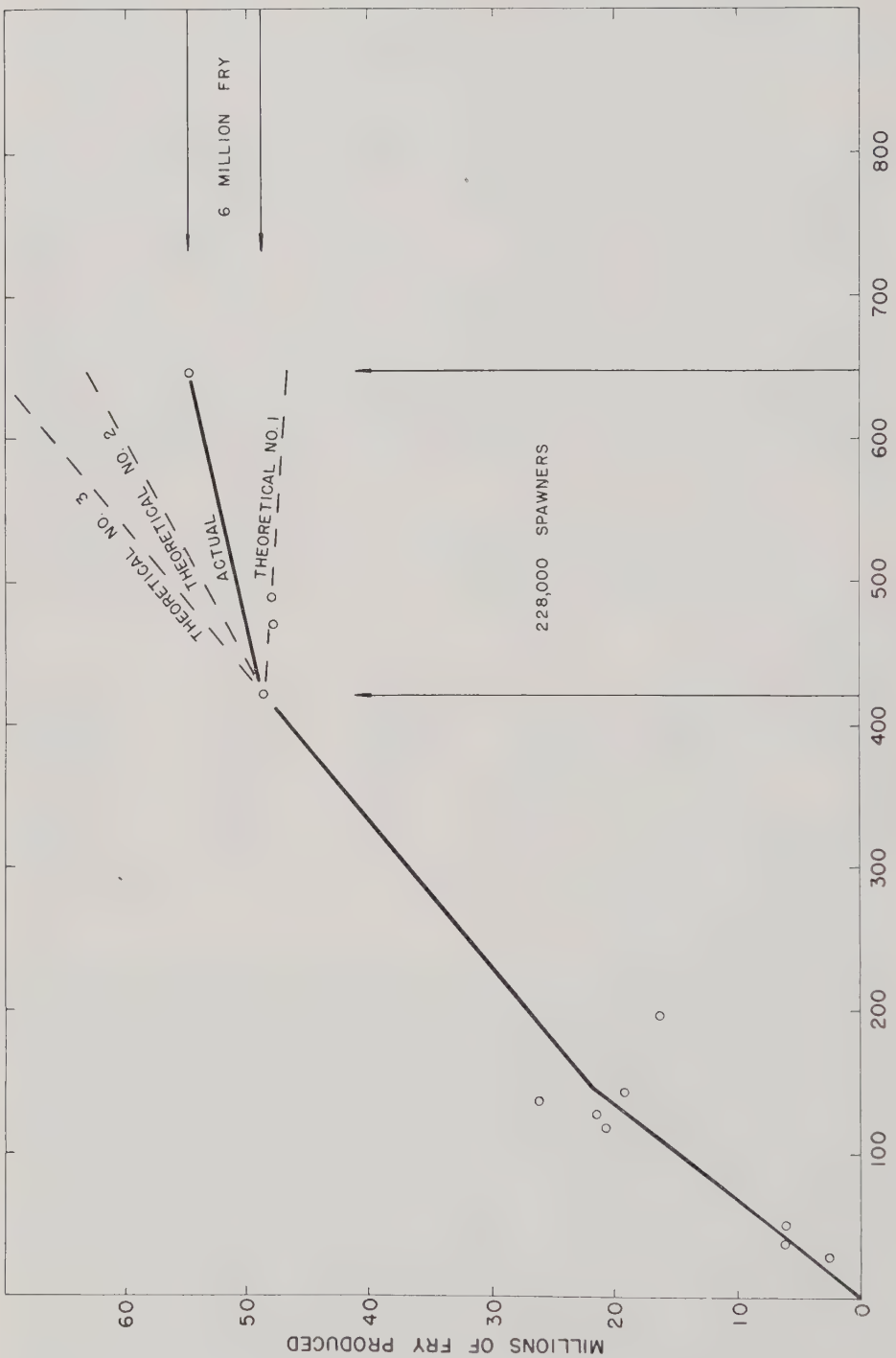

FIGURE 2 — The relationship of the Chilko escapement to the numbers of fry produced.

The policy of the Commission, in the case of the Adams River sockeye population and all other populations for which there is historical evidence of quadrennial dominance, is to provide escapements in proportion to the average size of the four annual runs making up the quadrennial cycle. As a result of this policy the required number of spawners differs substantially for each of the annual cyclical runs.

To illustrate the escapement requirements for each of four annual runs subject to quadrennial dominance the Late Adams sockeye run can be used as an example. In the year of the large or dominant run, as in 1962, over a million spawners are required. This is the number required to provide sufficient density of spawners over the available spawning area to produce fry at the most efficient level using both biological and economic factors as controlling criteria. In the following year (1963), based on historical evidence, the Adams River escapement should be somewhere between 150,000 and 200,000 sockeye. In the next two years, 1964 and 1965, less than 10,000 spawners appear to be sufficient. The naturally established difference in the average size of the four annual runs varies between producing areas but the example illustrates the method used in determining the variation in escapements for each of four annual sockeye runs to any producing area.

A determination of the specific numbers of sockeye required in a year when a dominant or large run returns to its place of birth is most important to the fishing industry since the required escapement limits the catch accordingly. The terms minimum, maximum or satisfactory often are used to describe an escapement to an area where the population is limited by the number of fry produced rather than by the available rearing area. What do these terms mean?

Actual data obtained from the Chilko River spawning area illustrates the extensive investigations needed to assess accurately the number of spawners required to fulfill the principles of good management. Figure 2 shows the relationship between the number of spawners and the number of emergent fry over a period of 12 years. It will be noted that the number of fry is almost proportional to the number of spawners until the number of spawners exceed 420,000. Although the percentage of fry produced by spawners in excess of 420,000 drops very rapidly, the total number of fry produced continues to increase. The important question is whether the catch restriction necessary to provide spawners in excess of 420,000 can be justified economically by the resulting additional fry and eventual adult returns.

Data are also available for the past ten years on the number of smolts produced from a known number of fry entering Chilko Lake and on the number of returning adults. On the basis of these data it can be calculated that in six of the ten years the number of adults resulting from spawners in excess of 420,000 would have been less or only slightly more than the original number of spawners. As an example, 648,000 Chilko spawners were available in 1956, the cycle year of the large run, or 228,000 over that required for more efficient fry production. These excess spawners produced approximately 6,000,000 fry or 3,300,000 smolts. Using the known marine survival rate for each year's smolt migration over the past ten years the adult return from these 228,000 excess spawners for ten theoretical dominant runs over a 40 year period would have been as follows:

Marine Survival Rate For	*Theoretical Adult Return from 228,000 Spawners in Excess of 420,000 at Chilko*
1953 Run	597,000
1954 „	498,000
1955 „	197,000
1956 „	232,000
1957 „	218,000
1958 „	681,000
1959 „	528,000
1960 „	264,000
1961 „	33,000
1962 „	109,000

It can be concluded that 420,000 spawners are essential in the cycle year of the large Chilko population to provide an "adequate minimum escapement". Any number over 420,000 up to at least 648,000 can be termed a "maximum escapement". However, the fry production from any excess of spawners over 420,000 is sufficiently low that there are only four chances out of ten of the excess escapement being of any economic value to the industry.

When a Chilko sockeye population enjoys favorable marine survival conditions, a good catch is guaranteed so that the gamble of obtaining a good return from any excess in spawners over 420,000 may be warranted. When the population size is low because of unfavorable marine survival conditions and the catch is poor, allowing an excess number of Chilko spawners might be considered an unwarranted gamble because of high fixed operating costs within the industry.

Three theoretical situations also are projected in Figure 2. In the first case it is assumed that the total fry production actually was reduced when a spawning population exceeds 420,000. In this situation there would be no doubt that overspawning had occurred and actual harm had been caused by the excess spawners. In 1958 the electric fence was installed in the mouth of Adams River to prevent this type of situation. It is unfortunate that the beneficial effects of the fence were obscured by extremely poor marine survival but without it no catch from the returning run in 1962 could have been permitted.

In the second theoretical case, while there was a decline in the percentage of emergent fry from the excess spawners the actual number of fry produced was sufficiently great to guarantee that provision of excess spawners would be economically sound except in relatively infrequent years of very poor marine survival.

The third theoretical case in Figure 2 merely illustrates that the "minimum" escapement was not obtained with 648,000 spawners since the number of fry produced continued to be approximately proportional to the number of spawners.

It is obviously impossible or impractical to define the escapement required for all of the Fraser River sockeye spawning areas by the method established at Chilko. Lacking refined data, the other spawning ground areas have been phy-

sically measured and uniform spawning densities are used as a guide to determine adequate escapements. Where production is controlled by limited rearing areas growth of the young sockeye is used as a guide to fix the size of the escapement. In such a complicated fishery as that for Fraser River sockeye it will not be possible to obtain a precise number of spawners each year for each producing area. By observing the effects of unavoidable variation in the size of individual escapements from year to year the escapement requirements can be defined more accurately.

The net escapement from the commercial and Indian fisheries as measured on the spawning grounds was 48.4 per cent of the total 1962 run of 3,352,000 sockeye, (see Tables V and VI). The total of 1,622,960 spawners is substantially below that of the two preceding cycle years of 1958 and 1954, but most of the reduction was caused by a greatly reduced escapement to Adams River. In the light of the foregoing discussion it may be stated that while the 1962 Adams River escapement is a minimum, it is sufficient to produce a substantial run in 1966 if favorable survival conditions prevail.

Very limited fishing because of the small size of the individual sockeye runs placed added importance on test fishing operations in determining not only the amount of escapement for each individual run but also the approximate size of the later runs as they entered the fishing area. Test fishing in the Fraser River near Haney during periodic fishing closures, provided reasonably accurate estimates of the 'summer running' sockeye. However, test fishing and all other staff observations used in previous years did not provide satisfactory estimates of the Adams River escapement. Considerable weight was given the catch per unit of gear during early September in Georgia Strait as a measure of the residual numbers of late running fish, including the important Adams River population. This data proved to be the only usable measure of the number of Adams River sockeye available for escapement.

Purse seine test fishing in Juan de Fuca Strait during the Adams River run provided useful information on the small size of that run but, because of variable availability of the fish, the timing of the run could not be assessed adequately. A similar problem occurred at Lummi Island where a reef net was operated throughout the extensive closed periods.

It may be concluded in the case of Fraser River sockeye and pink salmon that no single testing operation or method of calculating run size or escapement can be relied upon with confidence. Every possible method for estimating run size and escapement must be utilized and even then considerable judgment must be exercised in evaluating the data. It is becoming increasingly evident that visual observations by experienced fishermen are of little value in evaluating the size of a population of sockeye or pink salmon. In 1962 a substantial percentage of fishermen in both countries were convinced that "millions" of Adams River sockeye were escaping during the extended closed seasons.

The danger of relying on one method of estimating escapement is amply illustrated by the 1962 Early Stuart sockeye run. A method of measuring the escapement of this early migrating race by test fishing has not yet been

developed because of the high flow of the Fraser River at the time. Since the run was expectd to be poor and an escapement of at least 40,000 fish was desired, all Convention waters except for the Fraser River area were closed to fishing during early July. An analysis of six previous runs revealed that not more than 40 per cent of the run would be taken in a two day fishing week in the Fraser area. However, in 1962, with a two day fishing week, the catch increased 50 per cent over that calculated from the operations of previous years and the resulting escapement of 25,446 must be considered unsatisfactory. The Bowron River escapement was below that of the brood year and it is considered below the desirable amount.

The escapements to the Nadina and Upper Pitt Rivers were substantially larger than those of the brood year. The increase in the number of fish spawning in Upper Pitt River was particularly helpful since this run has been declining steadily in conjunction with a deterioration of the spawning grounds. Current experiments should make it possible within the next year or two for the Pitt River experimental hatchery to produce fry equivalent in viability to naturally produced fry; thus, the adverse effects of the inferior spawning grounds could be offset by artificially spawning a significant part of the escapement and incubating the eggs in the hatchery. Pitt Lake, eighteen miles in length, appears capable of providing rearing habitat for more fry than has been produced by the system in any year to date.

The dominant Seymour run now occurs on this 1962 cycle in apparent synchronization with the dominant run to Adams River, both runs utilizing Shuswap Lake as a rearing area. While this year's escapement to Seymour River is below that of the brood year (1958) it is substantially larger than those occurring in the cycle years of 1954 and 1950. A favorable return from this year's escapement would provide a substantial catch and a renewal of the rapid trend towards the complete rehabilitation of the population.

The reduction in the 1962 escapement to Chilko over that recorded in the brood year is considered desirable on the basis of current knowledge. This cycle represents an off year in production and the escapement in the brood year (1958) is considered to have been too large.

The escapement to Stellako River, while above that recorded in the brood year, is not considered to be the optimum for this cycle. The run in 1962 represents the dominant cycle year and a larger escapement is considered necessary for maximum production. The rearing capacity of the adjoining Fraser Lake rather than the available spawning grounds appears to be the limiting factor in the size of the Stellako sockeye population.

The escapement to Lower Adams River is considered to be satisfactory in that it represents a density of spawners per square yard of available spawning area capable of producing a substantial number of fry. Escapements to Little River and South Thompson Rivers, both rivers being contributors to the 'Adams Run', were down substantially over those of previous cycle years. These latter spawning areas were not protected from overspawning by the electric fence in

1958 as was the case with the Lower Adams River spawning area. Sampling of the spawning nests in the winter of 1958-1959 revealed a very low survival in the Little and South Thompson Rivers in contrast to an excellent survival in Lower Adams River.

Increased escapements over those of the brood year were recorded in Gates, Portage and Silver Creeks, Birkenhead River and Cultus Lake; while a reduced number of spawners was observed in Harrison River and Weaver Creek.

In summary, it may be stated that while the total escapement is not an optimum number, it was distributed well and is capable of producing a good run in 1966 provided conditions for survival remain favorable.

Rehabilitation

The experimental sockeye hatchery on Seven Mile Creek, tributary to Upper Pitt River, was operated for the third consecutive season. In the spring period of 1962 3,711,000 fry were released from the station as the survivors of an egg take of 4,060,000 in the fall of 1961. The survival rate of 92 per cent from eggs to fry was normal under standard hatchery procedures and is substantially higher than the 77 per cent recorded in the initial season of operation in 1960-61.

A physiological and biochemical comparison of the fry produced in the hatchery and the fry produced naturally in Pitt River revealed some startling differences, all of them indicating that the hatchery fry were significantly inferior. These adverse differences in the hatchery fry occurred in spite of incubation in darkness as is the case with naturally spawned eggs. Exploratory experiments at the Sweltzer Creek Experimental Station into the cause or causes of differences in hatchery and naturally produced sockeye fry indicate strongly that a modern hatchery is incapable of producing a 'normal' fry, regardless of how that hatchery may be currently operated. It is becoming increasingly obvious that the established methods of artificial propagation must be redesigned in a manner not yet fully determined if fry are to be produced that approach equality with those produced naturally.

Egg taking operations at the Pitt River Hatchery were reduced during the 1962 spawning season pending the accumulation of knowledge to be gained from experimentation on how the hatchery could be redesigned to fulfill the purpose for which salmon hatcheries are built; namely, to increase adult production approximately proportional to the known increase in egg to fry survival over that occurring from natural spawning. A total of 1,093,000 eggs were taken from 441 female sockeye, artificially fertilized, and incubated at the hatchery under varying experimental conditions. The fry resulting from the various methods of incubation will be compared in quality with those emerging from the natural spawning grounds of Pitt River. These experiments, combined with the more extensive ones being conducted at the Sweltzer Creek Field Station, will undoubtedly reveal at least some of the basic principles which should be incorporated in a more satisfactory hatchery design and operation than that now in practice.

The failure of the Pitt and Birkenhead sockeye runs to maintain themselves, under existing fishing regulations which permit the maximum allowable catch of more numerous populations migrating at the same time, resulted in the Commission placing both river systems under careful scrutiny. In 1961 only 4.4 per cent of the potential eggs deposited in the Pitt River system during the previous fall survived to the emigrating fry stage. Egg deposition was followed by six major floods and alternating lengthy periods when the water flow was below that at the time the eggs were deposited. The low egg to fry survival rate from the 1960 spawning substantiated the field determinations that the spawning grounds of Upper Pitt River were extremely unstable.

During the 1961-1962 season flow conditions in Upper Pitt River were unusually favorable. Only one moderate flood occurred during incubation and minimum flows remained equal to those obtained during egg deposition. Egg to fry survival was excellent with 18.5 per cent of the eggs reaching the emigrating fry stage. A total of 5400 females produced 4,006,000 fry compared with only 2,109,000 fry produced by 11,664 female spawners during the previous season. Since the favorable flow conditions in Upper Pitt River during the 1961-1962 incubation season are a rare exception rather than the rule it is essential that a satisfactory method for artificially increasing fry production in this system be established as soon as possible.

Egg to fry survival in the Birkenhead River declined from 24.3 per cent for the 1960-1961 season to 13.3 per cent for 1961-1962. It is difficult as yet to assess the cause for the decline in the survival rate since flow conditions appeared similar for the two incubation seasons; however, 35.51 per cent of the female population died unspawned, a situation which occurred in varying proportions elsewhere in the Fraser River watershed during the same spawning season. This mortality, although corrected for in calculating egg to fry survival, may have reflected a below average viability of the eggs actually deposited. However, the egg to fry survival rate was sufficiently high even in the 1961-1962 season to indicate that factors other than the condition of the spawning grounds, possibly including both the Indian and commercial fisheries, are responsible for the decline in the size of the Birkenhead sockeye population.

Eyed egg transplants of sockeye to various barren spawning areas that once produced natural runs of sockeye have been carried out annually beginning in 1950. Some transplantations apparently have been a limited success and others have failed to return any fish at all to the recipient area. A summary of the experiments to date will aid in assessing the program.

The most promising results from an eyed egg transplant have occurred at Portage Creek, a short stream connecting Anderson and Seton Lakes near Lillooet, B.C. The original native sockeye population was destroyed apparently by a combination of hatchery operations and the Hell's Gate obstruction. In 1950, 300,000 eyed eggs originating from Lower Adams River, were incubated in Portage Creek. In 1954, 3505 spawners returned; in 1958, 4803 spawners were counted, and in 1962 the number returning was 12,034.

While an occasional pair of sockeye have been observed spawning in the Middle Shuswap River above Mabel Lake in previous years, it was not until

1958 that any significant number was recorded. In 1954, 1,396,000 eyed eggs originating from Lower Adams River, were incubated in the Middle Shuswap River. In 1958, 499 adult sockeye were observed spawning in this river and in 1962 without any additional transfer of eggs 457 spawning sockeye were counted.

Upper Adams River has received transplantation of eyed eggs from Seymour River almost every year beginning in 1950. A small return of 205 sockeye was recorded in 1954, an unknown number in 1958 and only 85 in 1962. In spite of additional transplants on this cycle year and the return of some fish, the transplanted population does not appear to be capable of maintaining itself. A few adults returned in the cycle year of 1956 and again in 1960 but in neither case did water conditions permit an accurate enumeration. Plants of eyed eggs in 1955 and 1957 did not result in any observed adult return.

Transfer of eyed eggs both in 1954 and 1958 from Seymour River to Salmon River, both tributaries of Shuswap Lake, failed to return any adult sockeye to Salmon River. Although this stream is quite small and subject to frequent use for local irrigation, it had a substantial sockeye run up to the occurrence of the Hell's Gate obstruction in 1913.

A few fish have returned to the Barriere River in each case where eyed eggs have been transplanted from Raft River. There is every reason to believe that fish returning to the Barriere River will be capable of maintaining themselves by natural reproduction. Returns are now being observed in Eagle River apparently resulting from egg transplants of Seymour River origin. A transplant of 318,000 eyed eggs from Forfar Creek on Middle River to Creek X, a tributary of Nadina Lake, failed to return any fish in 1960, the year of expected return.

Previously it has been reported that numerous transplants of sockeye fingerlings failed in their purpose of inaugurating new runs of this species in currently barren areas. Eyed egg transplants in moderate numbers have returned small runs of sockeye in certain experiments and none in others. It now appears that improved methods which will allow for a substantial increase in production of fry are necessary if there is to be any chance of inaugurating runs of economic value within a reasonable period of time. Only a *properly designed* hatchery to specifications yet to be finalized or an artificial spawning channel appear to offer any real chance of success.

In 1962, 1,023,000 eyed eggs of Seymour River origin were planted in Scotch Creek, tributary of Shuswap Lake. A total of 2,757,400 eyed eggs of Seymour River origin were planted in Eagle River, also tributary to Shuswap Lake.

PINK SALMON REPORT

Status of the Fishery

The size of the 1961 Fraser River pink salmon population was below any previous population in the history of the fishery. The small run was predicted in advance of the adult migration on the basis of assembled information relating to catch and escapement, factors controlling the success of incubation,

and environmental influences controlling adult survival. In view of the known facts little could have been done by the Commission to reduce materially the extent of the decline in the population which actually started with the 1957 run.

In 1956 when the progeny from the 1955 brood went into Georgia Strait, the local salt-water temperatures were relatively high. This adverse condition caused a substantial reduction in the potential size of the adult population returning in 1957. In the latter year a large escapement was recorded in all spawning areas including the historically important areas above Hell's Gate which were barren of spawners from 1913 to 1945. Spawning and incubation environments were excellent and a very large number of fry entered Georgia Strait in the spring of 1958. However, the spring and summer temperature reached record highs in the estuary of the Fraser River resulting in the 1959 run being even smaller than the one in 1957.

In 1959 overfishing occurred because of an increase in the availability of the fish to the gear. Since population size in the fishery can be estimated only on the basis of catch per unit of gear, the increased availability resulted in an exaggerated estimate of the allowable catch. The 1959 pink salmon escapement was 1,078,000 fish, down 55.6 per cent from the brood year escapement. Under normal circumstances the reduction in the size of the 1959 escapement would have caused a serious reduction in the size of the returning population; however, the major early-spawning segment of the escapement encountered an all time record high flow in its spawning areas. The resulting fry production was so small that even a suitable escapement would not have produced a returning run in 1961 of significant size. If marine survival conditions had not been favorable for the relatively few progeny of the 1959 brood the early Fraser River pink run would have been near extermination in 1961.

Drastic regulatory controls were placed on the pink fishery in 1961 which allowed an estimated 76 per cent of the total run to escape to the spawning grounds; up substantially from the 17 per cent recorded in 1959. While the 1961 escapement was far from adequate, in spite of the rigid fishing restrictions, favorable conditions for survival have existed throughout the life of the population from spawning to its oceanic stage. It is anticipated that there will be a substantial increase in the number of pink salmon returning in 1963, at which time every effort will be made to provide for a substantial escapement.

Research

Since July 3, 1957, the Commission has regulated the pink salmon fishery in Convention waters. With the development of the growing Canadian fishery in Juan de Fuca Strait, the power block for purse seiners, the drum purse seiner and the nylon gill net, the regulation of the fishery to obtain adequate escapement, while dividing the catch on an equal basis, is far from a simple operation. Tools have been developed during the three years of pink salmon management to aid in assessing run size and to provide for a definite percentage of the run to escape to the spawning grounds. The catch in each of the three years (1957, 1959 and 1961) has been equally divided and additional methods are now available to aid in avoiding a reoccurrence of the potentially serious overfishing that existed in 1959.

The Pink Salmon Coordinating Committee created from representatives of the Washington Department of Fisheries, the International Pacific Salmon Fisheries Commission, the Fisheries Research Board of Canada, and the Department of Fisheries of Canada has worked diligently to fulfill that provision of the Pink Salmon Protocol which provides that "The Parties shall conduct a coordinated investigation of pink salmon stocks which enter the Convention waters for the purpose of determining the migratory movements of such stocks". A report is now being completed for early submission to the two governments that assesses the destination, migration route, migration rate, time of passage and exploitation rate for the individual stocks of pink salmon available to the various fishing areas extending from Johnstone Strait in Canada to lower Puget Sound in the State of Washington.

Methods have been developed by the Commission for enumerating the escapement to the individual pink salmon spawning areas of the Fraser River watershed. The timing of the spawning migration of the individual stocks up the Fraser River has been defined. Continuing indices of environmental factors controlling the success of spawning, incubation, fry emergence and emigration have been established for all major spawning areas. Methods have been designed and utilized for measuring the abundance of fry in all major spawning areas and in 1962 an operation was started to approximate the number of fry produced by the total Fraser River escapement.

An index of the marine survival rate has been worked out which permits the prediction of the approximate size of the incoming population a few months in advance of its entrance into the fishery. Predicting population size will become more precise as additional data becomes available on the total fry emergence.

In summary, it may be stated that the knowledge required for the scientific management of the pink salmon stocks of the Fraser River is either available now or will be available within a few years as a result of current investigations. The existence of only one year class combined with the immediate departure of the emerging fry to their marine habitat obviously simplifies an understanding of how the population can be sustained at a maximum level. If the reproducing areas in fresh water and the estuarial rearing areas can be protected from environmental changes caused by man the only apparent obstacles to full production are the current and uncontrollable vagaries of the natural environment.

Rehabilitation

An artificial spawning ground adjacent to Seton Creek was completed during the summer of 1961 to offset the loss of 2500 lineal feet of Seton Creek flooded by the diversion dam of the B.C. Electric Company (Figure 3). The spawning channel is 3,000 feet in length, 20 feet in width, is provided with a siphoned flow of 40 cubic feet per second of water which is relatively silt-free, and has an estimated capacity of 10,000 pink salmon.

The natural population of pink salmon in Seton Creek was allowed unobstructed entry to the channel until spawning commenced. A total of 6711 fish or 11 per cent of the total Seton Creek population made use of the facility. A potential of 7,999,000 eggs was available, an estimated 6,860,000 eggs were deposited

FIGURE 3 — Seton Creek Artificial Spawning Channel (center of picture) built to replace area flooded by power diversion dam of B.C. Hydro Authority shown in background. Setan Lake is in the extreme background of the picture, Seton Creek is shown on the right and Cayoosh Creek on the left side of the picture.

and 3,592,000 fry were checked out of the channel in the spring of 1962 for an egg to fry survival rate of 52.4. The first year of operation may be termed a remarkable success especially since the resulting fry appeared equivalent to fry produced from spawning in natural stream areas. It is possible that the entire cost of the channel ($34,000) plus the minor operating expenses will be returned by the resulting increase in the 1963 pink salmon run.

The high rate of egg to fry survival in the Seton Creek channel and the continuing increase in the return of adult pink salmon to the Jones Creek channel, built for the Department of Fisheries of Canada in 1954, justifies immediate consideration of expanding this method of increasing pink salmon fry production wherever applicable. At one time the Chehalis River and the Lower Vedder River, both tributary to the lower Fraser River, provided substantial spawning areas for pink salmon. These spawning areas have become unstable in recent years due to logging operations and no longer can be considered relatively important in the production of this species. In addition there are several smaller tributaries with adequate flow which are too precipitous to allow for the spawning of pink salmon except at their junction with the Fraser River. All of these cases deserve careful study on the part of the Commission in carrying out its terms of reference.

WATERSHED PROTECTION

Protection of Fraser River sockeye and pink salmon from possible deleterious effects that could be created by other water use developments continues to be an important phase of the Commission's activities. While the Commission is charged with the responsibility for protecting Fraser River sockeye and pink salmon, the legal authority to obtain watershed protection is vested in the Department of Fisheries of Canada. In dealing with developments which would affect Fraser River sockeye and pink salmon, the Commission works in close cooperation with the Department of Fisheries of Canada and its staff act as technical advisors to the Department whenever appropriate.

The principal types of development that arise which may affect waters of the Fraser River system and which have to be evaluated with respect to their possible effects on the fishery are hydroelectric dams and related diversions, flood control dams, industrial and domestic waste disposal, forest spraying, mosquito control spraying, irrigation and domestic and industrial water supply diversions, placer mining, sand and gravel removal, dredging, log driving, logging adjacent to streams, minor channel diversions, road and railroad construction, and seismic exploration. The emphasis on any type of development varies from year to year, but the general trend of population growth and industrial expansion creates a greater number and variety of developments each year. The major concerns during 1962 were with disposal of wastes from bleached kraft pulp mills proposed for the Kamloops and Prince George areas, and with Fraser River Board studies of a coordinated system of dams for flood control and hydroelectric power generation.

Proposals for the establishment of pulp mills in the interior of the Province of British Columbia within the Fraser River drainage area were being actively considered by a number of companies in 1961, and the Department of Fisheries of Canada received a number of inquiries as to requirements for waste disposal

under terms of the Fisheries Act. The Department and the Commission made an intensive study of the possible effects of pulp mill wastes on the Fraser River fishery and of the means of preventing harmful effect through in-plant control of wastes and chemicals and through treatment of wastes. A report was prepared and distributed to those concerned containing recommended procedures and practices to be adopted. Two companies have now been granted the necessary permits by the British Columbia Government for obtaining pulp wood materials, and are proceeding with plans for the establishment of a mill at Prince George before 1966 and a mill at Kamloops before 1965. Preliminary negotiations were undertaken by the Department of Fisheries with both companies in respect to waste handling facilities to be provided to protect the fishery and it is expected that agreements will be reached with both companies early in 1963.

During 1962 discussions were also held with a chemical company regarding the establishment of a chlorine and caustic soda manufacturing plant near Nanaimo on Vancouver Island, and with a steel mill on the North Arm of the Fraser River near Vancouver regarding the proposed disposal of flue dust in the river. The development of these projects has not advanced during 1962. The effect on sockeye of a test spraying of forest with a fungicide "Phytoactin" was studied at Sugar Lake in cooperation with the Fish and Game Branch of the British Columbia Department of Recreation and Conservation. Due to adverse water temperatures, these tests were not conclusive.

The Fraser River Board, a Federal-Provincial agency, has been engaged for a number of years in study of means of providing flood control on the Fraser River system. In recent years this study has been directed toward a flood control system consisting of storage reservoirs near the headwaters of the river and associated hydroelectric generation plants which would make the system economically feasible. The Department of Fisheries of Canada is represented on this Board. The Department and the Commission have conducted concurrent cooperative studies to provide the Board with information pertaining to possible sites where there would be a minimum of interference with the fishery and sites where there would be serious fisheries problems.

One of the systems studied by the Board included a storage dam at the outlet of Stuart Lake, on the sockeye migration route to spawning grounds in Middle and Tachie Rivers and numerous tributaries of Stuart, Trembleur and Takla Lakes. The Commission and the Department made a cooperative study of the effect of this dam on the fishery and issued a report in 1962 detailing the fisheries problems. This report concluded that the proposed dam would create a number of serious problems which could result in the loss of salmon production from the Stuart River system. It was also concluded that the flood protection which would be obtained theoretically from storage on Stuart Lake could be obtained more economically by restoration of the dykes in the Lower Fraser Valley. It was recommended therefore that the proposed dam at Stuart Lake should not be considered further in studies of means of flood control. The Fraser River Board is now concentrating its studies on a system which does not include the Stuart Lake dam.

Through cooperative arrangements with the Provincial Water Rights Branch and the Provincial Gold Commissioner notice of all applications for water use licences and placer mining licences are forwarded to the Department of Fisheries

of Canada and through the latter to the Commission for comment and any necessary recommendations. These applications are examined to determine the effect of the proposed water use on the fishery, and in some cases technical discussions with the applicants are required to develop satisfactory solutions to the potential fishery problem. During 1962 a total of 400 water licence applications and 47 placer mining applications were reviewed by the Commission. A series of 26 applications were for placer mining leases on Bridge River over a thirteen mile reach upstream from its confluence with the Fraser River. This portion of Bridge River is used by increasing numbers of pink salmon for spawning, and because of the manner in which it was proposed to operate the leases, which would have resulted in loss of this spawning area for all practical purposes, the Commission objected through the Department of Fisheries of Canada to the granting of these leases.

The uncontrolled driving of logs down relatively small rivers which contain salmon spawning grounds can very seriously affect the survival of the salmon by damaging eggs or alevins in the gravel beds. In the northern part of the watershed logs may be stored during the winter logging season for transport to mills by water after the spring thaw. This period generally coincides with the emergence of the young salmon from the gravel and care must be taken to ensure that these fish are not harmed. In the two operations of this type, in the Nadina and Tachie Rivers, it has been possible through cooperation of the local Officer for the Department of Fisheries of Canada, to arrange for the log drive to take place after the fry have left the stream, thereby avoiding any damage.

The construction of additional fishways at Hell's Gate and Yale Rapids to improve high water passage conditions for Early Stuart sockeye, and at Thompson River Rapids to improve low water passage for pink salmon and Adams River sockeye salmon did not take place as planned because of the insufficiency of funds made available. Funds for these essential facilities have again been requested so that construction can proceed during 1963.

As a result of the very substantial loss of spawners observed in the Horsefly and Nadina Rivers in 1961 surveys have been made of possible means of controlling water temperatures at the spawning grounds in these rivers by introduction of colder water from available sources in nearby lakes. Evaluation of this and alternative means of preventing the losses of 1961 from recurring is continuing and it is expected that detailed recommendations for remedial measures will be made to the respective governments in the near future.

1962 PUBLICATIONS

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1961.

2. Progress Report Number 9.
Origin and Treatment of a Supersaturated River Water by H. H. Harvey and A. C. Cooper.

3. Progress Report Number 10.
The History of the Early Stuart Sockeye Run by A. C. Cooper and K. A. Henry.

4. Research Bulletin Number XIII.
Marine Tagging of Fraser River Sockeye Salmon by L. A. Verhoeven and E. B. Davidoff.

5. Report on the Fisheries Problems Associated with the Proposed Stuart Lake Storage Dam (Mimeographed). Prepared by the technical staffs of the Department of Fisheries of Canada and the International Pacific Salmon Fisheries Commission (Issued by the Canada Department of Fisheries).

TABLE I
SOCKEYE CATCH BY GEAR

United States Convention Waters

Year	Purse Seines			Gill Nets			Reef Nets			Total Catch
	Units	Catch	Percentage	Units	Catch	Percentage	Units	Catch	Percentage	
1962	225	505,028	66.57	395	192,078	25.32	64	60,694	8.00	758,637
1958	368	4,259,324	81.02	689	844,602	16.06	82	152,158	2.89	5,257,316
1954	297	3,764,949	78.34	447	861,895	17.93	74	179,414	3.73	4,806,258
1950	288	1,061,480	86.94	205	82,854	6.79	96	76,559	6.27	1,220,893

Canadian Convention Waters

Year	Purse Seines			Gill Nets			Traps			Total Catch
	Units	Catch	Percentage	Units	Catch	Percentage	Units	Catch	Percentage	
1962	74	165,062	19.73	1,430	660,577	78.98	0	0	0	836,399
1958	180	2,541,592	48.49	2,275	2,680,914	51.15	3	14,241	0.27	5,241,617
1954	236	2,410,564	51.24	1,798	2,265,335	47.97	3	32,822	0.70	4,722,463
1950	113	371,140	41.49	1,048	483,603	54.07	5	39,726	4.44	894,469

NOTE: Gear counts represent the maximum number of units delivering sockeye on any single day.
Unlisted troll catches of sockeye included in figures for total catch.

Table II

CYCLIC LANDINGS AND PACKS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1962			
Total Landings (No. Sockeye)	758,637	836,399	1,595,036
Share in Fish	47.56%	52.44%	
Total Pack (48 Lb. Cases)	72,235	78,047	150,282
Share in Pack	48.07%	51.93%	
1958			
Total Landings (No. Sockeye)	5,257,316	5,241,617	10,498,933
Share in Fish	50.07%	49.93%	
Total Pack (48 Lb. Cases)	450,066	418,704	868,770
Share in Pack	51.80%	48.20%	
1946-1962			
Total Landings (No. Sockeye)	30,102,070	30,056,413	60,158,483
Share in Fish	50.04%	49.96%	
Total Pack (48 Lb. Cases)	2,649,619	2,611,463	5,261,082
Share in Pack	50.36%	49.64%	
1962 *Cycle Catch*			
1962	758,637	836,399	1,595,036
1958	5,257,316	5,241,617	10,498,933
1954	4,806,258	4,722,463	9,528,721
1950	1,220,893	894,469	2,115,362
1946	3,551,310	4,240,198	7,791,508
1942	2,935,192	5,047,599	7,982,791
1938	1,408,361	1,900,220	3,308,581
1934	3,590,058	1,430,300	5,020,358
1930	3,544,714	1,043,318	4,588,032
1926	469,900	912,566	1,382,466
1922	513,848	580,144	1,093,992
1918	569,094	242,275	811,369
1914	3,555,890	2,137,177	5,693,067
1910	2,765,726	1,690,091	4,455,817
1906	2,030,550	2,066,604	4,097,154
1902	4,001,717	3,177,538	7,179,255

TABLE III

DAILY CATCH OF SOCKEYE, 1950-1954-1958-1962 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1950	1954	1958	1962	1950	1954	1958	1962	1950	1954	1958	1962
1		1,332			15,403			25,695		472,636	170,818	
2		6,000			20,880	30,780		16,883		446,988	326,983	
3					25,058	39,131				173,977	218,732	142
4						40,284	27,722				182,785	897
5		16,232				29,590	17,753				255,742	553
6		8,509			16,961	33,758	9,482	32,790		117,704	361,549	37,491
7		6,623			34,588			33,759	951	115,016	278,614	17,758
8		12,660			48,134			42,145	712	66,966	251,967	
9		8,676			41,470	91,674				71,330	270,105	
10					36,990	105,771			206	42,100	99,657	331
11						90,326	47,540		392	10,441	83,545	4,921
12		22,095				97,704	52,692		296	7,646	74,324	5,584
13		18,854			55,865	46,749	48,236	41,499	52	8,952	71,025	542
14		10,979			26,563			13,444	62	8,796	100,305	
15		10,248			18,115				40	10,409	44,837	
16		12,450			36,042	36,495				2,412	22,421	
17					52,889	72,456			898	1,229	80,171	
18						39,634			483	635	13,319	452
19		38,708				28,883			2,427	397	4,598	1,337
20		30,317			138,217	58,703	51,984	30,235	365	1,328		160
21		27,814	4,014		153,568		67,331	52,410	124	1,399		
22		24,719	6,199			91,515	62,943		67	1,239	22,260	
23		32,708	4,346	11,312	100,173	114,790				457	277,405	
24				12,930	131,748	83,238			12	308	6,769	
25				22,666	107,788	131,074	162,816		21	24	17,815	92
26				25,538		154,114	116,752		14	358		800
27		74,196			83,504	232,693	156,081		17	401		93
28		51,039	19,972		38,212		195,990		18	430		
29		43,155	10,697			406,321	218,385	183,264	11	159	42,564	
30		35,233	8,253	53,588	16,818	291,987	249,106			96	145,499	
31	14,286			33,591		359,793	173,652	52,971				
Totals	14,286	492,547	53,481	159,625	1,198,986	2,707,463	1,658,465	525,095	7,168	1,563,833	3,423,809	71,153
Troll and outside seine		3,566	26	388		32,348	1,092	426	453		109	23
Monthly Totals	14,286	496,113	53,507	160,013	1,198,986	2,739,811	1,659,557	525,521	7,621	1,563,833	3,423,918	71,176
June, Oct. & Nov. Totals										6,501	120,334	1,927
Season Totals									1,220,893	4,806,258	5,257,316	758,637

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Table IV

DAILY CATCH OF SOCKEYE, 1950-1954-1958-1962 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1950	1954	1958	1962	1950	1954	1958	1962	1950	1954	1958	1962
1		2,203	831		25,874				312	91,014	385,773	
2		250	1,695	2,469	26,390	152,014				152,294	466,479	
3				6,116	30,775	72,397			120	120,470	401,799	85,937
4						34,165	22,502		19,760		458,172	50,972
5		14,594				58,122	7,241		12,062	9,963	175,892	8,832
6		10,423			11,031	36,874	5,521	70,736	26,320	166,818		45,204
7		7,710	7,239		53,074			20,880	978	128,713		1,806
8		7,809	4,918		31,653				150	96,413	159,126	
9		495	7,149	22,160	20,121	398				101,374	199,470	
10				11,310	21,189	3,731			307	148,585	141,025	53,283
11				11,328	296	3,731	36,583		50		145,470	624
12	CLOSED	9,652				3,732	13,238		50		130,616	349
13		8,436			14,679	398	14,050	5,801	58	206,257		173
14		7,172	14,098		49,953				16	151,204		
15		7,135	11,789		29,973			33,515	16	180,631	2,486	
16		1,783	16,213	12,460	32,366	108,415				85	2,192	
17				12,708	38,300	92,423			16	569	1,974	
18						80,050			15	901	597	148
19		18,778				55,805			15	904	307	172
20		12,751			71,775	6,313	105,922	39,664	15	356		
21		10,854	12,140		42,085		241,232	28,275	10	606		
22		15,976	6,642		29,217		284,595		8	313	119	
23		8,810	9,276	22,916	45,742	158,921				307	74	
24				7,351	52,525	235,021			2	97	66	725
25					21,972	213,480	196,072		29,233	47,355	35	715
26		71,411				539,669	219,024		10,835	15,658	789	784
27		41,306			3,118	265,408	339,029		10,663	10,204		
28		33,001	19,301		40,252		315,589	50,144	4,980	19,086		
29		33,306	9,497		19,577		195,690	26,674		9,287	1,198	
30		17,346	11,443	68,666	13,918	520,136		33,735		4,435	391	
31	31,679			18,324	7,737	48,441		25,720				
Totals	31,679	341,201	132,231	195,808	733,592	2,689,644	1,996,288	335,144	115,991	1,663,899	2,674,050	249,724
Troll and outside seine		3,356	350	790		10,283	3,373	4,417		103	1,131	291
Spring salmon gill nets								1,424			263	1,540
Monthly Totals	31,679	344,557	132,581	196,598	733,592	2,699,927	1,999,661	340,985	115,991	1,664,002	2,675,444	251,555
June, Oct. & Nov. Totals									13,207	13,977	433,931	47,261
Season Totals									894,469	4,722,463	5,241,617	836,399

TABLE V

THE INDIAN CATCHES OF SOCKEYE SALMON BY DISTRICTS AND THE VARIOUS AREAS WITHIN THESE DISTRICTS, 1958, 1962

	1958		1962	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Skookumchuck and Douglas	1,000	—	1,270	37
Birkenhead River and Lillooet Lake	3,417	—	10,863	56
Harrison and Chehalis	1,550	—	2,000	25
TOTALS	5,967	—	14,133	118
LOWER FRASER				
Coquitlam to Chilliwack	8,765	—	6,650	19+
Chilliwack to Hope	8,170	—	23,235	109
Vedder River and Vicinity	1,375	—	4,400	40
TOTALS	18,310	—	34,285	168+
CANYON				
Hope to Lytton	5,890	—	29,650	253
TOTALS	5,890	—	29,650	253
LYTTON-LILLOOET				
Lytton to Lillooet	2,800	—	5,240	49
TOTALS	2,800	—	5,240	49
BRIDGE RIVER RAPIDS				
Rapids	4,700	—	7,860	74
Pavillion			1,100	31
TOTALS	4,700	—	8,960	105
CHILCOTIN				
Farwell Canyon	1,304	—	1,721	7
Hances Canyon	1,383	—	2,252	9
Alexis Creek	3,003	—	3,683	16
Siwash Bridge	2,434	—	5,349	22
Keighley Holes	1,240	—	1,797	8
TOTALS	9,364	—	14,802	62
UPPER FRASER				
Shelley	192	—	155	3
Alkali and Canoe Creek	250	—	375	7
Chimney Creek	260	—	2,375	45
Soda Creek	220	—	840	16
Alexandria	185	—	—	
Quesnel	280	—	600	11
TOTALS	1,387	—	4,345	82
NECHAKO				
Nautley Reserve	2,342	13	2,266	15
Stella Reserve	2,967	14	1,999	19
TOTALS	5,309	27	4,265	34
STUART				
Fort St. James	3,573	37	3,697	64
Tachie, Pinchi and Trembleur Villages	2,015	17	1,952	38
TOTALS	5,588	54	5,649	102
THOMPSON				
Main Thompson River	6,800	—	2,575	148
North Thompson River	250	—	490	21
South Thompson River	16,000	—	10,200	107
TOTALS	23,050	—	13,265	276
GRAND TOTALS	82,365		134,594	

* Number of permits issued to Indians in district.

The Indian catch statistics detailed above are obtained principally from the Protection Officers of the Canadian Department of Fisheries. These officers control the taking of sockeye for food by the Indian population residing throughout the Fraser River watershed.

TABLE VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1950, 1954, 1958, 1962

District and Streams	1962 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio	
		1950	1954	1958	1962		Males 4-5 yr.	Femal 4-5 y
LOWER FRASER								
Cultus Lake	Nov. 20-25	30,595	23,756	14,097	27,070	73	9,450	17,5
Upper Pitt River	Sept. 14-17	42,800	17,624	10,385	16,585	5	7,753	8,8
Widgeon Slough	Nov. 3-9	600	1,000	1,152	599	0	308	2
HARRISON								
Big Silver Creek	——	25	279	——	490	0	206	2
Harrison River	Nov. 10-15	33,860	28,800	14,701	8,162	0	3,957	4,2
Weaver Creek	Oct. 17-22	30,700	28,773	36,199	15,962	38	6,457	9,4
LILLOOET								
Birkenhead River	Sept. 22-28	72,767	41,201	33,055	52,146	25,777	10,322	16,0
SETON-ANDERSON								
Gates Creek	Sept. 8-12	——	47	81	1,046	887	64	
Portage Creek	Oct. 25-Nov. 2	Few	3,505	4,803	12,034	99	5,511	6,4
SOUTH THOMPSON								
Seymour River	Sept. 2-4	12,000	26,258	78,575	58,104	268	24,583	33,2
Eagle River	Sept. 9-15	——	4	31	169	2	71	
Scotch Creek	——	——	——	——	——	7	0	3
Anstey River	Sept. 15-20	——	——	——	77	0	33	
Upper Adams River	Sept. 15-20	0	205	Present	85	0	36	
Lower Adams River	Oct. 19-26	850,500	1,532,820	1,730,609	984,447	5,621	408,967	569,8
Little River	Oct. 19-26	376,000	427,850	409,480	115,881	662	48,128	67,0
South Thompson River	Oct. 19-24	41,500	87,611	123,864	19,152	109	7,954	11,0
Lower Shuswap River	Oct. 21-26	——	17,462	9,387	31,205	178	13,031	17,9
Middle Shuswap River	Oct. 22-27	0	0	499	457	3	191	2
Diverted Sockeye		0	0	1,006,177	0	0	0	
NORTH THOMPSON								
Raft River	Aug. 31-Sept. 3	6,400	10,551	10,215	7,613	0	3,183	4,4
Barriere River	Aug. 31-Sept. 3	0	0	0	14	0	6	
North Thompson River	Sept. 10-15	——	——	——	90	0	38	
CHILCOTIN								
Chilko River	Sept. 25-28	29,800	36,534	137,081	92,467	14,754	28,212	49,5
Taseko Lake	Aug. 27-29	500	3,500	7,538	657	8	320	3
QUESNEL								
Horsefly River	Aug. 30-Sept. 4	400	279	1,784	1,001	0	430	5
Mitchell River	——	0	18	65	5	0	2	
Little Horsefly River	Sept. 28-Oct. 3	——	——	14	72	0	29	4
NECHAKO								
Endako River	Aug. 31-Sept. 3	900	Present	522	236	9	96	1
Nadina River (Early)	Aug. 29-Sept. 4	1,950	2,219	804	450	3	190	2
Nadina River (Late)	Sept. 12-18				1,683	0	715	9
Nithi River	Sept. 1-3	125	46	5	25	0	11	
Ormonde Creek	Aug. 28-Sept. 1	732	538	210	47	0	20	
Stellako River	Sept. 29-Oct. 4	145,100	142,632	112,273	124,495	10	58,560	65,9
STUART								
Early Runs								
Ankwil Creek	Aug. 12-15	67	56	461	290	0	125	1
Driftwood River	Aug. 16-20	144	387	1,897	374	0	161	2
Dust Creek	Aug. 12-15	1,125	1,168	3,017	1,035	0	445	5
Felix Creek	Aug. 4-8	——	218	515	1,600	0	688	9
25 Mile Creek	Aug. 12-15	521	207	218	25	0	11	
15 Mile Creek	Aug. 12-15	54	41	105	25	0	11	
5 Mile Creek	Aug. 12-15	262	5	111	11	0	5	
Forfar Creek	Aug. 6-10	10,259	5,702	8,715	4,464	0	1,925	2,5
Frypan Creek	Aug. 12-15	69	266	57	243	0	105	1
Gluske Creek	Aug. 6-10	11,007	5,292	1,642	1,841	0	792	1,0
Kynoch Creek	Aug. 6-10	24,644	14,088	9,477	8,672	0	4,006	4,6
Narrows Creek	Aug. 12-15	2,265	2,756	1,823	666	0	292	3
Paula Creek	Aug. 4-8	——	36	333	405	0	174	2
Rossette Creek	Aug. 6-10	6,260	3,836	3,735	4,887	0	2,204	2,6
Sakeniche River	Aug. 12-15	234	——	500	20	0	9	
Sandpoint Creek	Aug. 12-15	——	508	875	243	0	105	1
Shale Creek	Aug. 12-15	638	279	657	306	0	132	1
Misc. Streams	Aug. 12-15	2,362	23	492	339	0	145	1
Late Runs								
Kazchek Creek	Sept. 15-20	243	83	369	77	4	28	
Middle River	Sept. 14-18	2,600	3,927	7,762	11,706	12	4,794	6,9
Pinchi Creek	Oct. 8-15	——	5	850	142	0	64	
Tachie River	Sept. 20-26	200	1,529	13,738	6,764	30	2,991	3,7
NORTHEAST								
Upper Bowron River	Aug. 20-25	16,266	10,774	14,871	6,292	6	2,640	3,6
TOTALS		1,756,474	2,484,698	3,815,826	1,622,960	48,558	660,689	913,7

TABLE VII

DAILY CATCH OF SOCKEYE, 1947-1951-1955-1959 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1947	1951	1955	1959	1947	1951	1955	1959	1947	1951	1955	1959
1						57,324	53,990		2,932		2,556	23,297
2		13,102				42,143	75,245		1,575	910		18,812
3		6,615				27,199	45,368	51,046	1,181	538		
4		9,589	7,228					91,067	1,482	986	2,364	
5		9,057	12,418					89,417	984	493	1,621	
6		9,490	6,713			44,899		139,733		325	1,424	
7			3,409			27,696	48,429	167,337	714	137	703	5,401
8				CLOSED	CLOSED	33,673	81,369	132,596	622		205	10,197
9		23,677				19,943	54,024		246	265		7,266
10		10,244					40,503	93,493	406	1,254		11,143
11		8,156	7,824				25,131	124,278	316	33,599	330	
12		6,570	8,251					80,698	248	6,580	255	
13		5,418	7,563			55,972		74,075		290	37	
14	CLOSED		7,265			39,260	30,632		805	138	131	
15						40,588	32,409		106		48	747
16		16,435				39,036	31,554		105	149		495
17		16,565				22,937	43,279	125,123	443	234		218
18		12,476	16,903		4,285		27,280	83,286	125	109	142	
19		13,501	17,687		8,308		2,222	64,087	240	109	70	
20		14,630	13,795	7,112	8,260	9,835				285	76	
21			11,878	5,962	7,669	10,513	16,714		69	216	123	154
22				5,008	3,838	7,992	12,623		87		77	99
23		58,796				5,544	17,133	924	272	38		56
24		59,917			8,081	2,162	10,967	125,615	57	9		8
25		54,748	38,584		4,953		8,413	67,372	36	14	36	
26		45,817	13,949		5,794			17,846	42	7	6	
27		42,981	29,915	16,216	6,234	2,467		33,994		1	27	
28			30,647	20,278	5,536	7,489	10,136		13	2	45	1,941
29				28,340	3,097	2,334	5,821		6		12	645
30		64,435		44,671		1,346	5,372		10			553
31		79,869			3,314	853	4,307	29,018				
Totals		582,088	234,029	127,587	69,369	501,205	682,921	1,591,005	13,122	46,688	10,288	81,032
Troll and outside seine	58	5	10,011	437	5,631	6,756	63,702	4,188	32	53	757	27
Monthly Totals	58	582,093	244,040	128,024	75,000	507,961	746,623	1,595,193	13,154	46,741	11,045	81,059
June, Oct. & Nov. Totals									8		4,902	6,462
Season Totals									88,220	1,136,795	1,006,610	1,810,738

Table VIII

DAILY CATCH OF SOCKEYE, 1947-1951-1955-1959 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1947	1951	1955	1959	1947	1951	1955	1959	1947	1951	1955	1959
1						34,757	12,463		264		6,361	18,874
2		24,501				50,315	53,491		114	52	486	19,749
3		16,133				14,127	44,447	15,439	117	32,198		6,740
4		13,850	8,734				41,692	16,614	222	15,955		1,581
5		14,078	13,388					5,000	138	12,617	22,777	
6		1,500	9,539			63,292		Strike		10,675	17,051	3,831
7			7,305			30,490		July 26		6	14,849	7,269
8				CLOSED		33,448		-Aug. 9	15,158		12,715	14,422
9		20,406			CLOSED	29,668	64,348	Incl.	9,684	20	128	27,728
10		11,909				18,040	61,049	228,536	6,796	15,622		31,362
11		8,186	5,701				66,105	145,352	5,537	7,739		306
12		9,464	5,122				38,165	125,006	52	9,229	146	
13		3,000	5,984			59,457		127,041		12,047	31,216	
14	CLOSED		5,960			27,445				25	16,921	24,349
15						13,579	41,061		25,814		29	22,769
16		15,184				8,442	52,783		29,309	4	3	16,543
17		10,116				2,453	31,403	165,960	44,304	40,944		22,802
18		10,134	9,561				29,679	83,683	39,708	27,599		18
19		13,384	7,827		738		16,703	41,091	0	19,424	9	
20		1,580	10,906	10,360	881	22,812				313	8	
21			20,569	8,871	695	10,325				54	1	19,365
22				12,214	333	14,583	12,249		31,284		10	10,636
23		38,081				16,428	27,296	55,943	33,250		1	19,305
24		30,178				392	24,536	104,920	54,538	24,783		15,459
25		32,319	58,985		1,192		21,638	49,084	22,593	12,057		
26		43,327	45,546		731	305	7,510	32,174	21	5,139		
27		10,313	26,579	4,672	483	46,086						
28			14,064	2,540	296	23,673						6
29					548	17,925	4,356		5,404			2
30		76,209				20,425	20,417		1,572			1
31		39,931				228	10,126	31,096				
Totals		443,783	255,770	38,657	5,897	558,695	681,517	1,226,939	325,879	246,502	122,711	283,117
Troll and outside seine			534	2,163	590	1,541	39,667	21,458	166			608
8" Gill Nets	3,469			506	10,329				882		693	37
Monthly Totals	3,469	443,783	256,304	41,326	16,816	560,236	721,184	1,248,397	326,927	246,502	123,404	283,762
June, Oct. & Nov. Totals									7,823	37,641	7,189	8,398
Season Totals									355,035	1,288,162	1,108,081	1,581,883

TABLE IX
SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1947, 1951, 1955, 1959

District and Streams	1959 Period of Peak Spawning	Estimated Number of Sockeye			
		1947	1951	1955	1959
LOWER FRASER					
Cultus Lake	Dec. 1-5	8,898	13,143	26,000	48,461
Upper Pitt River	Sept. 14-22	90,000	37,837	17,552	15,740
Widgeon Slough	Nov. 7-10	750	745	——	637
HARRISON					
Big Silver Creek	Sept. 17-24	——	200	191	64
Harrison River	Nov. 9-16	16,000	17,145	5,595	28,562
Weaver Creek	Oct. 17-20	6,500	12,979	21,330	8,379
LILLOOET					
Birkenhead River	Sept. 23-28	120,000	55,862	25,355	38,604
SETON-ANDERSON					
Gates Creek	Sept. 3-6	——	——	86	867
Portage Creek	Oct. 26-28	50	30	43	572
SOUTH THOMPSON					
Seymour River	Aug. 29-Sept. 3	10,000	24,344	9,511	52,325
Upper Adams River	——	0	0	0	0
Lower Adams River	Oct. 25-27	185,000	135,000	54,405	113,230
Little River	Oct. 28-Nov. 2	15,000	9,690	9,072	21,080
South Thompson River	Oct. 28-Nov. 2	100	500	0	472
Lower Shuswap River		0	0	23	0
Middle Shuswap River		0	0	0	0
NORTH THOMPSON					
Raft River	Aug. 31-Sept. 4	8,000	8,561	5,364	10,210
Barriere River	Sept. 5-10	——	108	103	203
Fennell Creek	Sept. 1-5	——	——	——	27
CHILCOTIN					
Chilko River	Sept. 29-Oct. 1	55,000	118,110	128,081	470,621
Tasko Lake	Sept. 2-6	——	500	4,400	16,410
QUESNEL					
Horsefly River		6	51	62	Present
Little Horsefly River	Sept. 25	——	——	——	27
NECHAKO					
Endako River	Sept. 3-7	450	742	594	1,463
Nadina River (early)	Aug. 31-Sept. 2	90	326	202	1,364
(late)	Sept. 16-20				
Nithi River	Aug. 23-28	60	90	79	218
Ormonde Creek	Sept. 2-4	40	120	27	74
Stellako River	Sept. 26-28	55,000	96,200	51,971	79,355
STUART LAKE					
Early Runs					
Driftwood River	Aug. 16-20	0	50	0	3
Forfar Creek	Aug. 6-10	1,500	13,600	68	281
Frypan Creek	Aug. 8-12	——	50	0	1
Gluske Creek	Aug. 9-14	200	3,787	99	97
Kynoch Creek	Aug. 9-14	10,000	32,825	1,029	1,123
Narrows Creek	Aug. 8-12	0	400	27	167
Rossette Creek	Aug. 8-12	2,500	10,000	916	911
Shale Creek	Aug. 8-12	0	190	0	2
Misc. Streams		——	121	31	78
Late Runs					
Kazchek Creek	Sept. 18-24	——	200	18	7
Middle River	Sept. 18-24	60	2,000	3,596	3,500
Tachie River	Sept. 24-28	——	100	4,000	2,500
NORTHEAST					
Upper Bowron River		23,945	21,770	9,355	29,247
TOTALS		609,149	617,376	379,185	946,882

Table X

DAILY CATCH OF PINKS, 1955-1957-1959-1961 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1955	1957	1959	1961	1955	1957	1959	1961	1955	1957	1959	1961
1		1			9,370			34,070	144,389		187,274	
2					16,341			27,621		308,214	157,077	
3				34	10,279		6,110			344,634		
4	6			61			10,378		154,128	198,795		
5	17			38		17,545	13,181		113,207			
6	10					12,487	12,221		167,703			
7	4				10,114		13,229		137,636		108,145	
8					24,948		9,036		55,612		153,233	
9		7	CLOSED		19,202					143,732	133,600	CLOSED
10		1		494	16,197		10,105	64,389		82,101	132,028	
11	36			398	10,225		16,642		141,602	115,338		
12	106					24,436	17,634		131,375	56,951		
13	111					43,316	19,633		24,818	786		
14	122				20,165	57,329			76,532			
15		108			23,491			45,358	38,369		41,645	
16		235			26,193			21,451		40,133	30,919	
17		164		6,592	47,162		57,658			50,380	14,021	
18	583			8,234	38,138		41,664		149,735	35,730		4,023
19	736			12,592	2,488	99,644	36,950		104,360	146		1,790
20	658		1,063			89,534			81,676	49		1,265
21	515		1,533		66,618	80,747		72,620	68,999			
22		1,423	1,127		65,570	110,833		51,641	66,773		8,427	
23		1,371			136,472		10,524			18,459	8,204	
24		1,193		25,288	122,729		316,210			12,369	4,195	
25	1,737			20,603	91,280		232,534		102,199	5,890	1,134	540
26	890			18,595		228,828	59,823	CLOSED	29,277			463
27	1,785		3,545			189,603	125,179		43,543			76
28	1,827		5,506		228,497	133,673			46,725			
29		1,837	5,114		135,610	97,861			15,696		3,790	
30		3,386	4,276		162,752						2,106	
31		2,848		24,759	161,889		232,046				2,252	
Totals	9,143	12,574	22,164	117,688	1,445,730	1,185,836	1,240,757	317,150	1,894,354	1,413,707	988,050	8,157
Troll and outside seine	4,830	42,145	40,259	20,449	778,434	102,386	126,019	40,671	540,117	10,748	6,545	1,683
Monthly Totals	13,973	54,719	62,423	138,137	2,224,164	1,288,222	1,366,776	357,821	2,434,471	1,424,455	994,595	9,840
June, Oct. & Nov. Totals									13,376	9,970	3,741	2,746
Season Totals									4,685,984	2,777,366	2,427,535	508,544

TABLE XI

DAILY CATCH OF PINKS, 1955-1957-1959-1961 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1955	1957	1959	1961	1955	1957	1959	1961	1955	1957	1959	1961
1		2			7,169	343		14,821	137,320		117,313	
2		1			6,943				67,163	192,149	89,335	
3		1		1	16,178					180,181	99,848	
4	17	6		1	11,082		13			147,730	19,653	
5	5	7				20,779			299,702	91,813		3,335
6	6					41,304			175,474	58,796	95,733	2,198
7	13					43,086			182,104		52,704	
8		6				162			136,765		92,362	
9		6	CLOSED		32,507	163		18,773	117,875	20,398	131,918	
10		6		4	45,148		25,687	22,031		113,427	88,337	
11	51	10		4	52,906		24,563			96,826	9,774	
12	115	10		6	40,857	88,365	24,718		94,543	57,295		936
13	93			29		53,273	34,625	4,954	228,496	40,518		569
14	181					116,580		3,753	191,906		29,041	
15		22			67,273	79,958		80,913	31,326		57,720	
16		33			72,500			56,892	4,719	44,764	45,086	
17		55		13,807	76,519		40,111			70,693	37,960	
18	818	101		8,909	63,697		29,604			33,112	1,169	
19	522	19			94,825	79,913	1,749		19,245	42,847		344
20	1,020		1,603			77,578			10,069	66,096		260
21	1,494		1,807			91,077		15,144	4,989		20,122	431
22		3,091	2,880		154,777	110,547		39,029	4,543		17,566	
23		7,849			163,202		201,421		3,112	1,455	36,721	
24		5,078		27,564	212,995		225,659			1,628	22,104	
25	4,684	206	JULY 26-AUG. 9	22,427	211,931		146,148			1,498		
26	6,145			18,841	267,348	113,470	98,483		1,046	226		89
27	3,838					84,368			671	139		30
28	3,097					114,618		5,480	1,060		93	22
29		2,078	STRIKE		251,150	164,983		12,061	240		202	
30		8,170			238,032				373	10	63	
31		14,928		9,097	170,565		123,443					
Totals	22,099	41,685	6,290	100,690	2,257,604	1,280,567	976,224	273,851	1,712,741	1,261,601	1,064,824	8,214
Troll and outside seine	2,216	3,398	27,542	26,208	46,117	30,460	179,795	34,659	12,052	4,788	44,467	20,038
Spring salmon gill net									6,888		482	37,330
Monthly Totals	24,315	45,083	33,832	126,898	2,303,721	1,311,027	1,156,019	308,510	1,731,681	1,266,389	1,109,773	65,582
June, Oct. & Nov. Totals									69,346	12,221	13,282	44,138
Season Totals									4,129,063	2,634,720	2,312,906	545,128

TABLE XII
SUMMARY OF THE PINK SALMON ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS

District and Streams	*Period of Peak Spawning*	*Estimated Number of Pink Salmon* 1957	1959	1961
EARLY RUNS				
LOWER FRASER				
Main Fraser	Sept. 25-Oct. 5	1,263,651	733,933	549,400
HARRISON				
Chehalis River	Oct. 5-12	9,336	6,729	11,921
FRASER CANYON				
Coquihalla River	Oct. 2-7	4,433	16,088	7,316
Jones Creek	Sept. 23-30	1,493	2,604	5,088
Lorenzetti Creek	Oct. 1-10	6	991	218
Silver Creek	Oct. 1-5	549	1,914	705
Hunter Creek	Oct. 1-10	13	234	140
American Creek	Oct. 1-10	4	790	147
Spuzzum Creek	Oct. 2-20	1,076	2,111	263
Nahatlatch River	Oct. 2-5	208	216	244
Anderson Creek	Oct. 1-10	824	567	166
Stein River	Oct. 2-5	185	62	83
Churn Creek	——	8	0	0
Texas Creek	——	0	195	0
Popkum Creek	——	0	57	0
Flood Creek	——	0	8	0
Yale Creek	Oct. 1-10	0	510	31
Emory Creek	Oct. 1-10	0	728	22
Stoyoma Creek	——	0	42	0
Kawkawa Creek	Oct. 13-20	317	1,279	502
Ruby Creek	Oct. 5-12	0	528	448
SETON-ANDERSON				
Seton Creek	Oct. 1-8	58,810	14,887	58,717
Portage Creek	Oct. 1-5	1,867	52	1,550
Bridge River	Oct. 5-10	0	1,201	1,895
Yalakom River	——	0	13	0
THOMPSON				
Thompson River	Sept. 28-Oct. 8	266,329	86,342	69,179
Nicola River	Oct. 4-10	1,560	806	216
Bonaparte River	Sept. 27-29	653	3	8
Deadman River	Sept. 18-20	564	0	8
Nicoamen River	——	0	73	0
TOTALS		1,611,886	872,963	708,267
LATE RUNS				
LOWER FRASER				
Stave River	Oct. 20-25	6,500	1,383	3,994
Whonnock Creek	Oct. 20-25	549	57	278
Suicide Creek	——	2	0	0
Silverdale Creek	Oct. 20-25	52	68	88
Kanaka Creek	Oct. 20-25	153	18	23
South Alouette River	——	8	0	0
North Alouette River	——	8	0	0
Silver Creek (Pitt Lake)	——	239	0	0
Coquitlam River	——	6	0	0
HARRISON				
Harrison River	Oct. 13-20	585,798	110,311	186,137
Weaver Creek	Oct. 8-14	346	87	539
CHILLIWACK-VEDDER				
Chilliwack-Vedder River	Oct. 15-20	212,334	91,517	188,066
Sweltzer Creek	Oct. 15-18	6,874	751	6,224
Little Chilliwack Creek	——	68	0	0
Brown Creek	——	44	0	0
Slesse Creek	Oct. 15-20		317	55
Middle Creek	Oct. 12-15		528	434
TOTALS		812,981	205,037	385,838
GRAND TOTALS		2,424,867	1,078,000	1,094,105

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